Module 08 – Scheduling Problem

Exploratory Data Analysis

Month	Workers Required
1	228
2	313
3	431
4	483
5	423
6	312
7	260
8	328
9	466
10	556
11	520
12	394

agency	Month of service
The Chewy Charm	9, 10
The Peppermint Post	6, 7
Bubbly Bear Co.	8, 9
Snickerdoodle Street	3, 4, 5
Peppermint Peekaboo	10, 11, 12
Crumb & Coated	1, 2

Full Time Employee Mean Salary: $9,021

employee	monthly_salary
Pixie Peppermint	$ 5,909.20
Sunny Sassafras	$ 8,670.95
Bubbles Butterbean	$ 11,133.44
Sugarplum Sally	$ 9,388.17
Twinkle Taffybell	$ 8,579.04
Lulu Licorice	$ 9,103.50
Maple Marshmallow	$ 8,878.90
Candyfloss Claire	$ 7,116.73
Caramel Clementine	$ 11,838.10
Gummy Gus	$ 9,171.71
Marshmallow Molly	$ 11,436.22
Taffy Twinkleton	$ 10,326.84
Gumdrop Grace	$ 8,044.30
Fizzwick Frost	$ 10,664.17
Nifty Nougatine	$ 7,536.15
Nougat Nelly	$ 12,640.16
Chuckles Choco	$ 6,185.19
Cherry Chewella	$ 8,154.73
Poppi Lollipop	$ 11,208.19
Fizzabelle Pop	$ 7,482.26
Zippy Licorice	$ 7,555.37
Benny Bonbon	$ 9,338.31
Twirly Tina	$ 9,934.50
Whimsy Whiskers	$ 7,888.28
Ginger Gumdrop	$ 12,841.78
Cocoa Clement	$ 4,861.47
Crispy Crumbcatcher	$ 10,299.08
Sprinkle Bea	$ 10,623.14
Scooter Snickerdoodle	$ 8,764.28
Chuck ChocoChip	$ 6,014.37
Tina Tootsie	$ 7,885.54
Snickersnack Sam	$ 7,843.56
Misty Mallow	$ 10,294.35
Jellybean Juniper	$ 9,101.87
MEAN SALARY	$ 9,021.00

Foot traffic
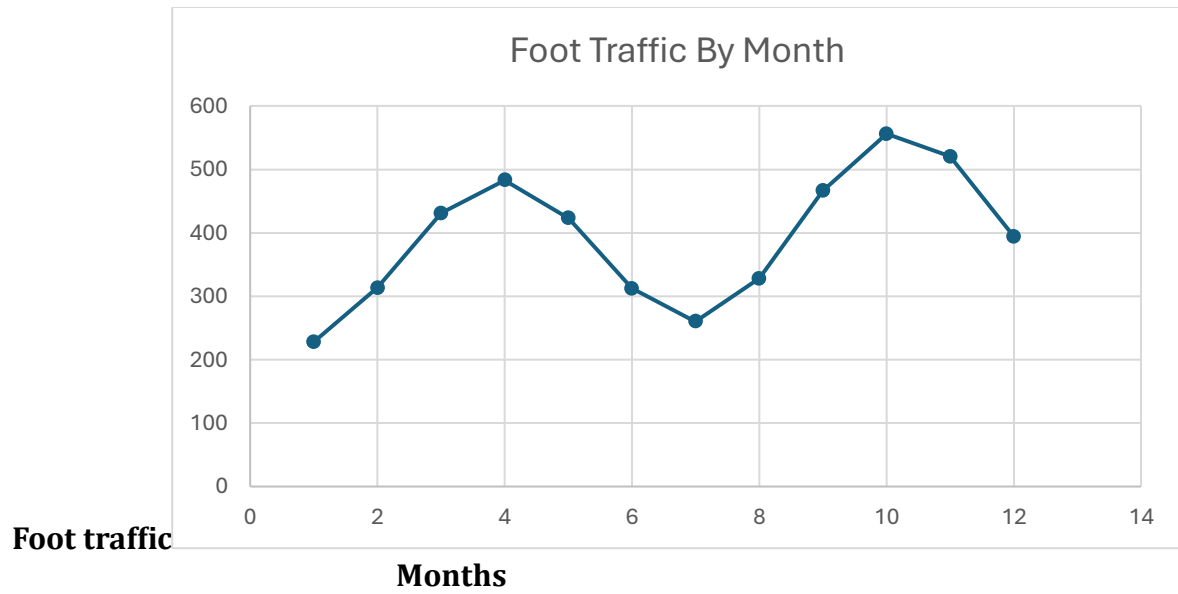
Months

In the graph above we can see seasonality in the winter or colder months with drops during the warmer months and summer, with a peak in Month 10 (October) with 556.

Model Formulation

Objective Function:
MIN: 19,728A1 + 26,996A2 + 20,006A3 + 38,151A4 + 37,527A4 + 18,134A5 + 108,251.95A6

Subject to:

0X1 + 0X2 + 0X3 +0X4+ 0X5 + 0X6 + 0X7+ 0X8 + 1X9 + 1X10 + 0X11+ 0X12 } A1

0X1 + 0X2 + 0X3 +0X4+ 0X5 + 1X6 + 1X7 + 0X8 + 0X9 + 0X10 + 0X11+ 0X12} A2

0X1 + 0X2 + 0X3 +0X4+ 0X5 + 0X6 + 0X7+ 1X8 + 1X9 + 0X10 + 0X11+ 0X12 } A3

0X1 + 0X2 + 1X3 + 1X4 +1X5+ 0X6 + 0X7+ 0X8 + 0X9 + 0X10 + 0X11+ 0X12 } A4

0X1 + 0X2 + 0X3 +0X4+ 0X5 + 0X6 + 0X7+ 0X8 + 0X9 + 1X10 + 1X11+ 1X12 } A5

1X1 + 1X2 + 1X3 +1X4+ 1X5 + 1X6 + 1X7+ 1X8 + 1X9 + 1X10 + 1X11+ 1X12 } A6

Model Optimized for Min Costs to Cover Store Foot Traffic

	Months on												Workers	
	1	2	3	4	5	6	7	8	9	10	11	12	Scheduled	Wages per Worker
The Chewy Charm	0	0	0	0	0	0	0	0	1	1	0	0	138	$ 19,728.00
The Peppermint Post	0	0	0	0	0	1	1	0	0	0	0	0	0	$ 26,996.00
Bubbly Bear Co.	0	0	0	0	0	0	0	1	1	0	0	0	15	$ 20,006.00
Snickerdoodle Street	0	0	1	1	1	0	0	0	0	0	0	0	170	$ 38,151.00
Peppermint Peekaboo	0	0	0	0	0	0	0	0	0	1	1	1	207	$ 37,527.00
Crumb & Coated	1	1	0	0	0	0	0	0	0	0	0	0	0	$ 18,134.00
Fulltime Employees	1	1	1	1	1	1	1	1	1	1	1	1	313	$ 108,251.95
Avalible	108251.9471	108251.947	37527	37527	37527	20006	20006	38151	65147	45130	18134	18134		
Required	228	313	431	483	423	312	260	328	466	556	520	394		Total -> $ 51,159,172

Model with Stipulation

Please do both of the following:

1. *Unfortunately, leadership wishes to have a reduction in workforce. While the monthly salary for full time employees is cheaper than temporary workers, there are other costs associated with full time employees that they wish to cut. Add a constraint to your model that takes your first model's recommended number of full-time employees and constrains it to be only 80% of it. Add a text explanation of the change in the optimal value as well as any other changes noticed between the models.*

					Months on								Workers Scheduled	Wages per Worker
	1	2	3	4	5	6	7	8	9	10	11	12		
The Chewy Charm	0	0	0	0	0	0	0	0	1	1	0	0	138	$ 19,728.00
The Peppermint Post	0	0	0	0	0	1	1	0	0	0	0	0	62	$ 26,996.00
Bubbly Bear Co.	0	0	0	0	0	0	0	1	1	0	0	0	78	$ 20,006.00
Snickerdoodle Street	0	0	1	1	1	0	0	0	0	0	0	0	233	$ 38,151.00
Peppermint Peekaboo	0	0	0	0	0	0	0	0	0	1	1	1	270	$ 37,527.00
Crumb & Coated	1	1	0	0	0	0	0	0	0	0	0	0	63	$ 18,134.00
Fulltime Employees	1	1	1	1	1	1	1	1	1	1	1	1	250	$ 108,251.95
Avalible	313	313	483	483	483	312	312	328	466	658	520	520		
Required	228	313	431	483	423	312	260	328	466	556	520	394		Total -> $ 53,183,586

Within this model the optimal value increased. Because the full-time employees are cheaper, taking them away would allow the leadership to distribute more hours to other agencies.

2. *Alternatively, leadership would like to see what the average monthly salary for an employee would need to be to cut out all temporary workers as they believe that will help negate excess spending. Convert your model (or do the math out yourself) to figure out what monthly salary you would need to pay your full-time employees to only have full-time workers at the same optimal cost as the original model.*

In my opinion, as someone in leadership I would keep the additional cost incurred with the extra labor employees. In theory I believe this is the best choice because in theory I would think about call outs and having the extra staff will help especially in our peak seasons where we will need all of the extra hands we can get.

AVG monthly salary with stipulation	$ 7,971.16
AVG monthly salary original model	$ 7,668

3. *Considering trends and seasonality of this business, what would you recommend leadership to do? Feel free to play with the model and recommend something else.*

Considering trends and seasonality of this business, I would recommend leadership hiring more employees during their peak months. The company could implement seasonal workers to work during the peaks so there could be more staff during the heavier load months.